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EP 0 209 791 B1

Description

The present invention relates to a method of manufacturing a sheet-like laminated structure such as an electronic memory card which is used as a credit card, an identification card, and the like, and incorporates an integrated circuit pellet (e.g., an IC, LSI, or the like).

An electronic memory card incorporating an integrated circuit pellet (e.g., an IC, an LSI, or the like) has been recently developed. When the integrated circuit pellet is adhered to a substrate inside the electronic memory card by an adhesive, since the integrated circuit pellet is small, it is difficult to precisely and reliably mount the electrodes of the pellet on the connecting terminals of the substrate due to technical limitations. For example, the electrodes of the pellet may not be reliably and satisfactorily mounted on the connecting terminals of the substrate, thus impairing the reliability of the electrical connection there-between.

U.S.P. No. 3,701,464, U.S.P. No. 3,887,783, and U.S.P. No. 4,222,516 disclose a technique for mounting the electrodes of the pellet on the connecting terminals of the substrate. In an information card disclosed in these patents, each conductor of an IC chip is soldered to a corresponding conductor strip. However, during soldering, each conductor of the IC chip is carefully aligned to the corresponding chip, and is then secured thereto. This assembly leads to low productivity of information cards, and is not suitable for mass-production. In this method, an alignment apparatus and a soldering apparatus of very high precision are necessary. In particular, in the information card disclosed in U.S.P. No. 4,222,516, a high-precision machining technique is required to form the terminals extending outside the card. The information card of this structure is also unsuitable for mass-production.

EP 0 140 230 and EP 0 071 255 disclose a card comprising a number of layers and an IC pellet located in a recess. The pellet has connection pads connected to external terminals via conductor leads. The card has a substrate, contact surfaces and adhesive film. In particular, EP 140 230 discloses a method that bonds the different layers together using heat and pressure.

It is an object of the present invention to improve a method for manufacturing an electronic memory card having a sheet-like laminated structure which can easily and reliably connect a plurality of contacts of an integrated circuit pallet to an insulating substrate.

According to the present invention, a method for manufacturing a sheet-like laminated structure is provided, having a plurality of external contact terminals comprising the steps of:

providing carrier means for carrying a plurality of conductive leads thereon; and

providing insulating means on said carrier means, for covering at least said plurality of conductive leads;

and comprising the further step of

urging external contact terminals by means of an external force to cause said external contact terminals to be inserted from outside said sheet-like laminated structure into said insulating means and to pass through said insulating means, and to contact said conductive leads.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing an electronic memory card;

Fig. 2 is a sectional view of a semiconductor pellet incorporated in the card shown in Fig. 1;

Fig. 3 is a perspective view showing the semiconductor pellet shown in Fig. 2;

Fig. 4 is a sectional view of the card shown in Fig. 1;

Fig. 5 is an exploded perspective view of the card shown in Fig. 1;

Fig. 6 is a perspective view of an electronic memory card;

Fig. 1 shows an electronic memory card.

The electronic memory card 1 has a thickness of about 0.8 mm, and incorporates integrated circuit (IC) pellet 2, as will be described later. Magnetic stripe portion 3 and external connection terminal portion 4 are arranged on the front surface of card 1, and embossed portion 5 is formed on the back surface thereof. Magnetic data (e.g., a verification code of the card) is recorded on magnetic stripe portion 3. Embossed portion 5 is formed by embossing to project from the back surface of card 1 or to be pitted in the front surface, so as to represent identification data (e.g., the name of a card holder, an identification code, and the like). As shown in Fig. 2, in IC pellet of 4 x 4 x 0.4 mm size, a semiconductor element (e.g., a MOS transistor) serving as active region 6A is formed on silicon substrate 6, and insulating layer 7 (e.g., an SiO_2 layer), in which through holes 7A are formed at predetermined positions, is formed on active region 6A. Aluminum is formed on insulating layer 7 by a vapour deposition and is then etched to form an internal wiring pattern and electrode pads 8 to be connected to an external circuit. Insulating layer 9 (e.g., an SiO_2 layer) in which through holes 8A are formed at predetermined positions is formed on electrode pads 8. Aluminum is formed on insulating film 9 by a vapour deposition, and is then etched to form external electrode pads 10 having a size larger than that of pads 8. In contrast with a con-

ventional IC chip, the pellet having the above described structure is not provided with bonding wires and resin capsule. As shown in Fig. 3, external electrode pads 10 are aligned on the uppermost surface of pellet 2 in a 4 x 2 matrix, and insulating layer 11 (e.g., an SiO_2 layer) is arranged between pads 10. Some of electrode pads 10 in the 4 x 2 matrix are electrically connected to internal electrode pads 8 through corresponding through holes 8A, and the remaining electrode pads 10, e.g.; two lower electrode pads 10A and 10B, are auxiliary pads and are not connected to pads 8.

In electronic memory card 1 incorporating IC pellet 2, intermediate inner core 14 for storing wiring substrate 13 is adhered to the lower surface of upper inner core 12 for storing IC pellet 2, and lower inner core 15 is adhered to the lower surface of core 14, as shown in Fig. 4. Upper- and lower-surface films 16 and 17 are laminated on the upper surface of core 12 and the lower surface of core 15, respectively. Films 16 and 17 are formed of a soft resin (e.g., poly-vinyl chloride added with plasticizer), and magnetic stripe portion 3 is formed on the surface of film 16. Inner cores 12, 14, and 15 are formed of a hard resin (e.g., vinyl chloride). Storage portion 12A for storing pellet 2 is formed in inner core 12, and storage portion 14A for storing wiring substrate 13 is formed in inner core 14 to correspond to portion 12A of core 12, as shown in Fig. 5. Wiring substrate 13 arranged in storage portion 14A of core 14 is a film-like sheet, and is slightly larger than pellet 2. Internal connection terminals 13A and external connection terminals 13B are aligned on the upper surface of substrate 13. Internal connection terminals 13A are connected to electrode pads 10 of pellet 2, and external connection terminals 13B are connected to contact terminals 18A, 18B, 18C,..., 18H of external connection terminal portion 4. More specifically, IC pellet 2 is adhered onto wiring substrate 13 through anisotropic conductive adhesive tape 19. Thus, internal connection terminals 13A are electrically connected to electrode pads 10 by tape 19. Tape 19 is prepared by mixing conductive particles 13C (e.g., Ni, Al, Carbon, and the like) with hot-melt type insulating adhesive. When IC pellet 2 is adhered to the upper surface of substrate 13 through tape 19, electrodes opposing each other through tape 19 are electrically conducted, but adjacent electrodes are not. Contact terminals 18A, 18C, 18D,..., 18H of terminal portion 4 connected to external connection terminals 13B of substrate 13 are formed of a conductive metal, and each has flat head portion 4A and projection 4B formed integrally therewith. In the manufacture of electronic memory card 1 with the above structure, a thermocompression bonding tool is brought into contact with head portions 4A of terminals 18A, 18B, 18C,..., 18H, and their projections 4B are inserted in upper inner core 12 from above film 16. Next, projections 4B of terminals 18A, 18B, 18C,..., 18H heated by the bonding tool partially melt upper inner core 12, and are inserted therein until the lower ends of projections 4B are brought into contact with terminals 13B. Upper film 16 corresponding to head portions 4A of terminals 18A, 18B, 18C,..., 18H is locally gelled and, thereafter, is bonded to portions 4A after the bonding tool is released. Therefore, terminals 18A, 18B, 18C,..., 18H are bonded to film 16 and inner core 12, and electrode pads 10 of IC pellet 2 are electrically connected to terminals 18A, 18B, 18C,..., 18H through wiring substrate 13. The upper surfaces of terminals 18A, 18B, 18C,..., 18H buried in film 16 are in substantially the same plane as that of the upper surface of film 16, and the upper surface of card 1 is flat. Terminals 18A and 18B of terminals 18A, 18B, 18C, ..., 18H are auxiliary terminals, and are connected to pads 10A and 10B. Terminal 18C receives reference voltage Vcc, terminal 18D serves as a GND terminal, terminal 18E receives a reset signal, terminal 18F receives a high voltage V_{pp} for writing a data, terminal 18G receives a clock signal, and terminal 18H receives address and data signals as input/output signals.

In the electronic memory card of the above structure, each of contact terminals 18A, 18B, 18C,..., 18H of terminal portion 4 has a structure wherein each projection 4B extends from the lower surface of flat head portion 4A. Projections 4B are inserted in film 16 from above using a thermocompression bonding tool to partially gel film 16 and, thereafter, are bonded thereto. Therefore, contact terminals 18A, 18B, 18C,..., 18H can be effectively bonded to upper film 16 through a simple operation.

Another embodiment of the present invention will now be described with reference to Fig. 6. The same reference numerals in Fig. 6 denote the same portions as in Figs. 1 to 5, and a detailed description thereof will be omitted.

In an electronic memory card shown in Fig. 6, wiring pattern 21 is arranged directly on the upper surface of inner core 20 for storing pellet 2, and pellet 2 and contact terminals 22 are connected to pattern 21. More specifically, inner core 20 is made of a hard resin (e.g., vinyl chloride), and storage portion 20A is formed in a predetermined portion thereof. Wiring pattern 21 formed on inner core 20 is formed by etching a copper foil adhered to the entire surface of inner core 20 except for storage portion 20A. Connection leads 21A formed by extending wiring pattern 21 are connected to external connection pads 10 of IC pellet 2, and external connection terminals 21B are connected to contact

terminals 22 of external connection terminal portion 4. In the electronic memory card shown in Fig. 6, when external connection pads 10 of pellet 2 are connected to the corresponding connection leads 21A of wiring pattern 21, the connecting portions are sealed by mold resin 23 inside storage portion 20A of inner core 20. Each contact terminal 22 of terminal portion 4 has flat head portion 4A and projection 4B extending from the lower surface thereof, as in the first embodiment. Contact terminals 22 are compressed and inserted in upper film 16 from above by a thermo-compression bonding tool to partially gel a portion of film 16, and are then bonded thereto. Therefore, the lower ends of contact terminals 22 are connected to connection terminals 21B of wiring pattern 21. In the electronic memory card of this embodiment, each contact terminal 22 is buried in film 16 so that its upper surface projects slightly from film 16, and is held in film 16 only by its bonding force. Note that upper and lower films 16 and 17 are laminated on the upper and lower surfaces of inner core 20.

The above electronic memory card has a structure suited for mass-production, and has inner core 20 with a simple structure, thus reducing the thickness of the card.

In the previous embodiment, each contact terminal of external connection terminal portion 4 is thermally bonded directly to upper film 16 and upper inner core 12. However, if a guide hole is formed in upper film 16 and upper inner core 12, and an adhesive is interposed between the lower surface of head portion 4A of terminal 22 and upper film 16, each contact terminal can be bonded by simply compressing and inserting it therein.

Claims

1. A method for manufacturing a sheet-like laminated structure having a plurality of external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22), comprising the steps of:

   providing carrier means (12, 13, 14, 15, 17) for carrying a plurality of conductive leads (13A, 13B; 21) thereon; and

   providing insulating means (16) on said carrier means (12, 13, 14, 15, 17), for covering at least said plurality of conductive leads (13A, 13B; 21); characterized by the further step of

   urging external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) by means of an external force to cause said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) to be inserted from outside said sheet-like laminated structure into said insulating means (16), and to pass through said insulating means (16) and to contact said conductive leads (13A, 13B; 21).

2. The method according to claim 1, characterized in that said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22;) are urged by means of said external force, to pierce and pass through said insulating means (16).

3. The method of claim 2, characterized in that said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22), urged by said external force, cause at least a portion of said insulating means (16;) to at least partially gel when passing through said insulating means (16), to then cause said at least partially gelled portions of said insulating means (16) to bond to said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22).

4. The method of any one of claims 1 to 3, characterized in that said external contact terminals (22) are arranged so that upper surfaces thereof project slightly from an upper surface of said insulating means (16).

5. The method of claim 1, characterized by comprising the steps of bonding said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) to said insulating means (16).

6. The method of claim 5, characterized in that said external contact terminals (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) are bonded to said insulating means (16) by means of an adhesive.

Patentansprüche

1. Verfahren zur Herstellung eines plattenförmigen, laminierten Aufbaus mit einer Vielzahl äußerer Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22), folgende Schritte umfassend:

   Bereitstellen einer Trägervorrichtung (12, 13, 14, 15, 17) zum Führen einer Vielzahl stromleitfähiger Leitungen (13A, 13B; 21) auf dieser; und

   Bereitstellen einer Isoliervorrichtung (16) auf der Trägervorrichtung (12, 13, 14, 15, 17) zum Abdecken zumindest der Mehrzahl stromleitfähiger Leitungen (13A, 13B; 21);

   gekennzeichnet durch den weiteren Schritt

   der Einwirkung auf die äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) mit Hilfe einer Kraft von außen, um zu bewirken, daß die äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) von außerhalb des plattenförmigen, laminierten Aufbaus in die Isoliervorrichtung (16) einsetzt werden und durch die Isoliervorrichtung (16) verlaufen und die stromleitfähigen Leitungen (13A, 13B; 21)

berühren.

2. Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, daß mittels der Kraft von außen so auf die äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22;) eingewirkt wird, daß sie die Isoliervorrichtung (16) durchstechen und durch diese verlaufen.

3. Verfahren gemäß Anspruch 2, dadurch gekennzeichnet, daß die äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22), auf die die Kraft von außen einwirkt, bewirken, daß zumindest ein Teil der Isoliervorrichtung (16) wenigstens teilweise geliert, wenn sie durch die Isoliervorrichtung (16) verlaufen, um dann zu bewirken, daß die wenigstens teilweise gelierten Teile der Isoliervorrichtung (16) sich mit den äußeren Kontaktanschlüssen (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) verbinden.

4. Verfahren gemäß einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die äußeren Kontaktanschlüsse (22) so angeordnet sind, daß ihre oberen Oberflächen geringfügig von einer oberen Oberfläche der Isoliervorrichtung (16) abstehen.

5. Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, daß es die Schritte des Verbindens der äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) mit der Isoliervorrichtung (16) umfaßt.

6. Verfahren gemäß Anspruch 5, dadurch gekennzeichnet, daß die äußeren Kontaktanschlüsse (4A, 4B, 18A, 18B, 18C, ..., 18H; 22) mittels eines Klebstoffes mit der Isoliervorrichtung (16) verbunden sind.

Revendications

1. Procédé de fabrication d'une structure laminée en forme de feuille comportant une pluralité de bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22), comprenant les étapes de :

fourniture d'un moyen de support (12, 13, 14, 15, 17) pour supporter une pluralité de connexions conductrices (13A, 13B ; 21) dessus ; et

fourniture d'un élément isolant (16) sur ledit moyen de support (12, 13, 14, 15, 17) pour recouvrir au moins ladite pluralité de connexions conductrices (13A, 13B ; 21) ;

caractérisé en ce qu'il comprend en outre l'étape de :

application d'une poussée sur les bornes de contact externe (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22) au moyen d'une force externe pour provoquer l'insertion desdites bornes de contact externes (4A, 4B, 18A, 18B, 18C ..., 18H ; 22) depuis l'extérieur de ladite structure laminée en forme de feuille à l'intérieur dudit moyen d'isolation (16) ainsi que leur passage au travers dudit moyen d'isolation (16) et que leur entrée en contact avec lesdites connexions conductrices (13A, 13B ; 21).

2. Procédé selon la revendication 1, caractérisé en ce que lesdites bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22) sont poussées au moyen de ladite force externe pour percer ledit moyen isolant (16) et passer au travers.

3. Procédé selon la revendication 2, caractérisé en ce que lesdites bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H : 22) poussées par ladite force externe provoquent la gélification au moins partielle d'une partie dudit moyen isolant (16) lors de leur passage au travers dudit moyen isolant (16) pour ensuite provoquer la liaison desdites parties au moins partiellement gélifiées dudit moyen isolant (16) auxdites bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22).

4. Procédé selon l'une quelconque des revendications 1 à 3, caractérisé en ce que lesdites bornes de contact externes (22) sont agencées de telle sorte que leurs surfaces supérieures dépassent légèrement d'une surface supérieure dudit moyen isolant (16).

5. Procédé selon la revendication 1, caractérisé en ce qu'il comprend les étapes de liaison desdites bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22) audit moyen isolant (16).

6. Procédé selon la revendication 5, caractérisé en ce que lesdites bornes de contact externes (4A, 4B, 18A, 18B, 18C, ..., 18H ; 22) sont liées audit moyen isolant (16) au moyen d'un adhésif.

FIG. 1

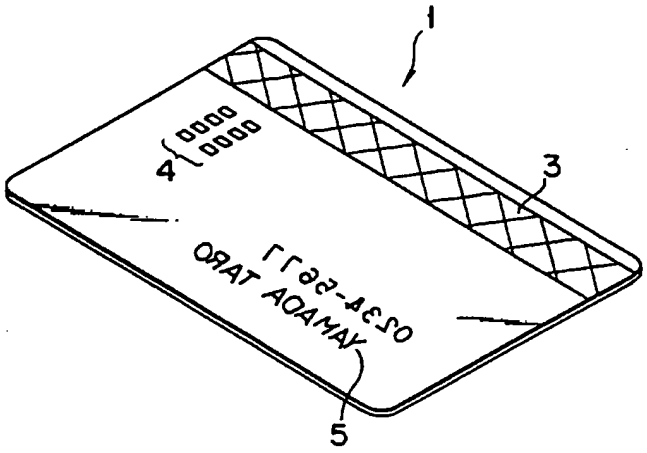
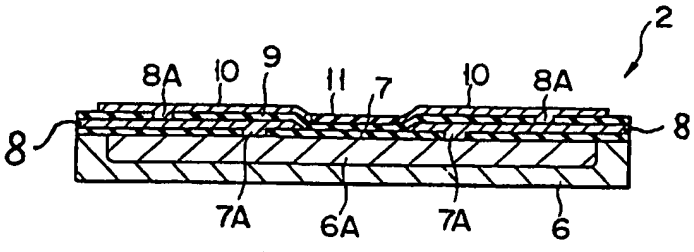


FIG. 2



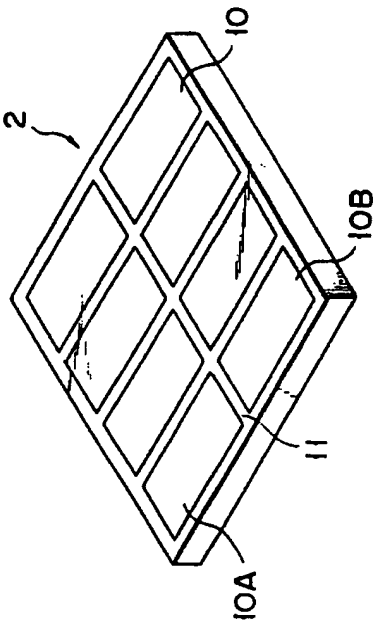

2
10
10B
11
10A

FIG. 3

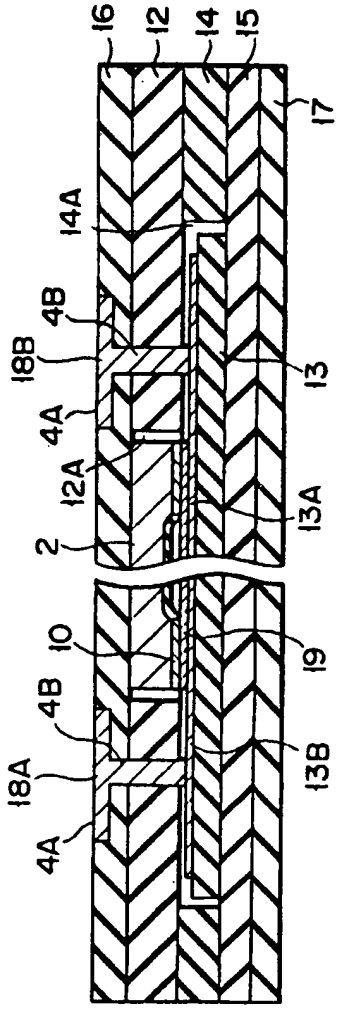

16
12
14
15
17
14A
4B
18B
13
4A
12A
13A
2
10
19
4B
13B
18A
4A

FIG. 4

FIG. 5

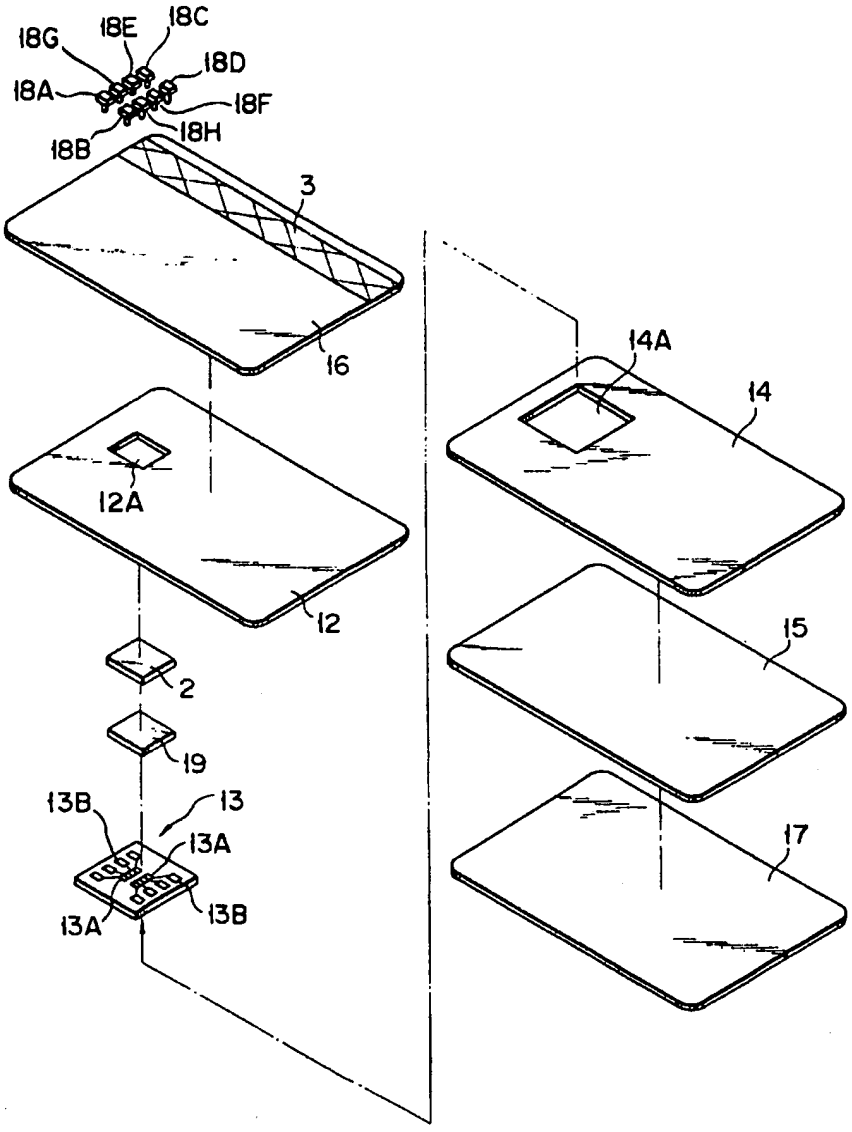

18G
18E
18C
18D
18A
18F
18H
18B
3
16
14A
14
12A
12
15
2
19
13B
13
13A
13A
13B
17

FIG. 6